LENSES

WP6

D6.2 Policy indicators and framework for Nexus-relevant NBS

Caterina Righetti, Giorgia Bottaro,

Mauro Masiero and Davide Pettenella (UNIPD)

roject coordinator

Project partners

Project Website

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

Graphics: Francesco Ambrosini (CREA)

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

Project no. 2041

Project acronym: LENSES

Project title: Learning and action alliances for NEXUS environments in an uncertain future

Call: PRIMA call Section 1 – Nexus 2020, Topic 1.4.1-2020 (IA).

Start date of project: 01.05.2021

Duration: 36 months

Deliverable title: D6.2–POLICY INDICATORS AND FRAMEWORK FOR NEXUS-RELEVANT NBS

Due date of deliverable: November 2022

Project Coordinator: Stefano Fabiani, Council for Agricultural Research and Economics (CREA)

Organisation name of lead contractor for this deliverable: University of Padova (UNIPD)

Lead Author

Email

Contributions from

Internal Reviewer 1

Internal Reviewer 2

Dissemination level		
PU	**Public**	**PU**
CO	**Confidential, restricted under conditions set out in Model Grant Agreement**	
CI	**Classified, information as referred to in Commission Decision 2001/844/EC**	

History			
Version	**Date**	**Reason**	**Revised by**
01	23/11/22	Internal review	Linda Barci, Juan Diego Restrepo (Etifor) and Tuncay Topdemir, Zübeyde Albayram (UTAEM)
02	DD/MM/YY		

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

Table of Contents

List of tables

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

List of figures and boxes

Abstract

LENSES WP6 requested to provide the methodological and practical foundations for the validation of Nature based Solutions (NBS), in order to guide pilots in the delivering of Nexus-added values. In response to the request, the Working Group on Task 6.2 worked on the definition of a technical guideline to allow the project's pilots to assess the policy enabling environment and governance challenges for Nature-based Solutions (NBS) and devised the following objectives:

- Investigate whether and how WEFE Nexus and NBS concepts are addressed within key European and international policy documents.
- Create an exercise that can guide LENSES pilots to investigate WEFE and NBS concepts within national and subnational policies.
- Collect and present criteria on the most relevant NBS policy and governance frameworks.
- Develop a new framework to support the analysis of the enabling environment capable of assessing how well policy and governance conditions are conducive to the implementation and success of an NBS project.
- Develop a framework user guide to give instructions on the use of the framework to promote its application and circulation among LENSES pilots and other potential final users.

The aim of the report is to provide a useful tool for those who want to design and implement an NBS so that they can work on the less impactful aspects of their NBS project and make it successful. It is important to note that the results of these activities present an initial framework that can be further elaborated and improved through users' suggestions.

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

Acronyms and abbreviations used within the text

DEVCO	Directorate-General for International Cooperation and Development
EbA	Ecosystem-based Adaptation
EU	European Union
IUCN	International Union for Conservation of Nature
LIFE Programme	L'Instrument Financier pour l'Environnement
MEA	Millennium Ecosystem Assessment
NBS	Nature-Based Solution
OECD	Organisation for Economic Co-operation and Development
SDGs	Sustainable Development Goals
WEF	Water, Energy, Food Nexus
WEFE Nexus	Water, Energy, Food, Ecosystem Nexus

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

1. Introduction

Nature-based Solutions (NBS) are living and supported by natural processes solutions developed for various environmental problems and providing numerous benefits to ecological, social and economic systems (European Commission, 2016).

NBS play an important role in addressing challenges related to the Water-Energy-Food-Ecosystems (WEFE) Nexus or to climate change adaptation and disaster risk reduction, simultaneously providing benefits for human well-being and protecting ecosystems. However, for NBS to be successfully adopted, a framework for their design, implementation, and monitoring is needed to ensure the long-term sustainability of NBS interventions in a specific context.

On the one hand, it is necessary for national governments to create an institutional, policy, regulatory and financial environment that facilitates the adoption of NBS by both public agencies and private actors (OECD, 2020). Indeed, governments play a key role in promoting the use of NBS. On the other hand, it is important that governance arrangements and technical capacity do not discourage their use. Therefore, the actors in charge of designing and implementing the NBS intervention must consider different opportunities for NBS integration and address systemic barriers between different sectors and levels of governance related to the Nexus.

This report falls within the scope of Task 6.2 of the LENSES project. The objective of this task is to provide the technical guidelines to analyze the evidence base and available methodologies, develop criteria to allow the pilots to assess the policy enabling environment, as well as address governance challenges for NBS. Building on what emerges in the literature, the aspects that hinder and those that enhance the success of an NBS project were examined (Maes and Jacobs, 2015; Kabisch *et al.*, 2016; Nesshöver *et al.*, 2017; Dale *et al.*, 2019; Seddon *et al.*, 2020), emphasizing the work of IUCN (2020) and OECD (2020), which have been working on developing criteria and enabling conditions for NBS.

This work aims to bring together key insights on the policy and the governance of NBS to identify successful governance, management, finance and public participation schemes for the extended implementation of NBS. We aimed to produce a coherent and all-encompassing framework of all the dimensions and different elements that have already emerged as relevant for an NBS project, enriched with new aspects and evaluation parameters. Thus, starting with an analysis of existing policies that consider the WEFE Nexus approach and already support adoption and investment in NBSs, we further explored aspects of governance, technical capacity, financing, and management of NBSs. For each of these elements, a precise indicator was defined whose presence or absence may affect the long-term sustainability of the NBS project.

In chapter 2 the methodology used to achieve the objective of Task 6.2 is illustrated. In the remaining sections the results of Task 6.2 are presented in detail and discussed. Finally, a guideline (chapter 6), a framework validation from the pilots (chapter 7) and an example of the

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

implementation of the framework with reference to two specific cases (chapter 8) is provided for a better understanding of the framework.

2. Methodology

To define a technical guideline and develop criteria to allow pilots to assess the policy enabling environment and governance challenges for Nature-based Solutions (NBS) a preliminary analysis on the European and international policies regarding the WEFE Nexus and NBS was carried out.

Initially, the policy areas which could involve WEFE Nexus-related theme were identified. These include biodiversity, forests, agriculture, environment, climate change, energy, water, growth/development and cohesion, and research. Then, the most relevant international and European policy documents for each of these areas were searched for. The documents were analyzed via the identification of policy indications related to the single elements of the WEFE Nexus, i.e., water, energy, food and agriculture, and ecosystems. These terms have been used as keywords to perform the texts analysis. The presence of an explicit reference to the WEFE Nexus or to the interdependence between WEFE elements was also verified. After this, a reference to the adoption of NBS was investigated within the same documents. Therefore, several key-terms included within the umbrella concept of NBS were searched, including ecosystem-based approaches, ecosystem-based adaptation, ecosystem-based disaster risk reduction, green infrastructure/blue infrastructure, ecosystem-based management/sustainable forest management, preservation/ maintenance or restoration of habitats or ecosystems.

An excel document (Annex 1) was created to systematize the information found with one sheet dedicated to the international policies and another one to the European policies. Each sheet reports the policy area, the name of the policy document, the , the presence of a WEFE Nexus element (coded as: W for water, E for Energy, F for food, ES for ecosystem) or an explicit reference to it (Nexus), the keywords used to refer to the Nexus or one or more of its components, the reference about where to find these indications (document chapter, article, etc.), the key words providing indication on the NBS, the reference where to find these indication (chapter, article, etc.), the weblink to the source.

The development of a framework to support the analysis of the governance enabling environment was carried out starting from the identification and investigation of existing policy and governance assessment frameworks inherent to NBS. Building on the existing tools, we worked to develop a broader evaluation framework capable of assessing how well policy and governance conditions are conducive to the implementation and success of an NBS project. The framework consists of key dimensions, key elements, and the associated indicators. The framework put together some key dimensions and elements reported by OECD (2021) with selected IUCN (2020) criteria translated into new key elements or dimensions and associated with IUCN indicators, governance indicators

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

reported in other studies, and newly developed indicators. All the key dimensions, key elements, indicators, the corresponding indicator description and a scoring method for the optimality degree of policy and governance environment were organized within two different user-friendly excel file (Annex 2 and Annex 3).

The policy and governance evaluation framework developed was validated by LENSES pilots.

The figure below (Figure 1) synthesizes the approach used for the policy and governance analysis.

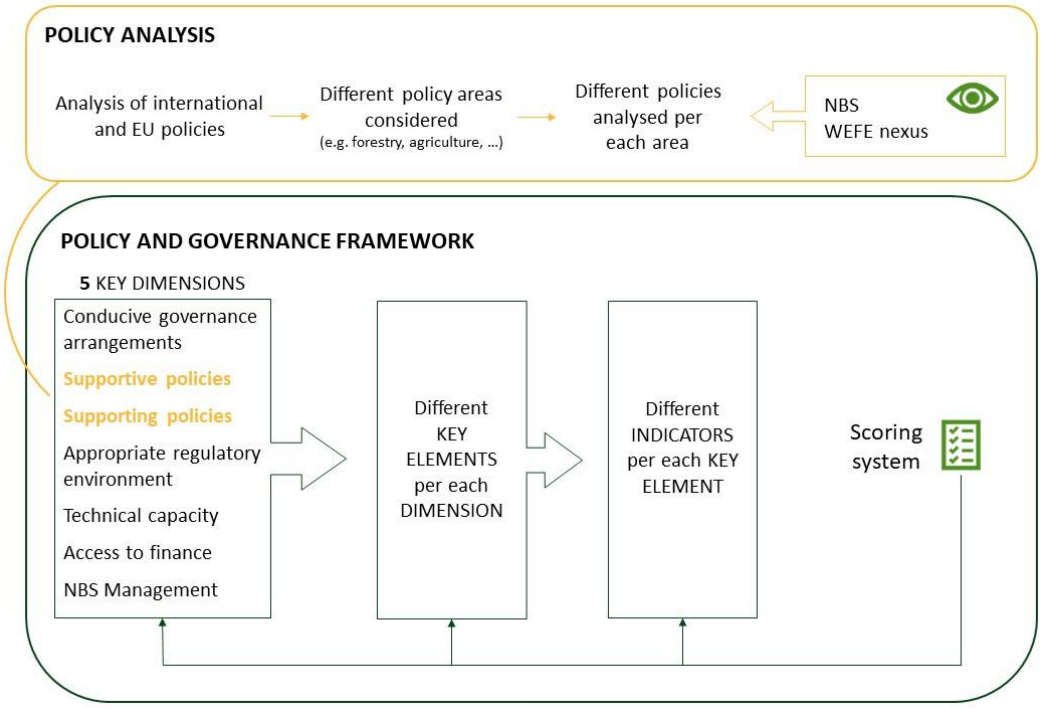

Figure 1: General scheme of the approach for the policy and governance analysis

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

3. The WEFE Nexus and the NBS in the context of international and EU policy

Water, energy, agriculture, and ecosystems have strong interconnections that affect food, water, energy, and ecosystem security. The balance between these different elements is crucial for human well-being, poverty reduction, and sustainable development (Liu *et al.*, 2018).

The link between water, energy and food was first highlighted in 2011 during the Nexus conference in Bonn, which aimed to identify new sustainable development solutions in a green economy context. In the light of this goal, the WEF Nexus aimed to support better efficiency in resource use by reducing trade-offs and creating synergies, and thus increase WEF security (Hoff, 2011).

Over the years, ecosystem health has been increasingly recognized as an important condition for ensuring sustainability in development solutions (MEA, 2005). WEF security relies on resources and services provided by healthy ecosystems. Therefore, the focus has more recently moved on the WEFE Nexus. The Position paper on WEFE Nexus and sustainable development goals (SDGs) by Adamovic *et al.* (2019) states that "*the WEFE Nexus aims to increase Water, Energy, and Food security without compromising ecosystems services. In practical terms, the WEFE Nexus helps to improve understanding and systematic analysis of the interactions between the natural environment and human activities in these three sectors*". It also defines the key principles of the WEFE Nexus: understand the interdependence of resources within a system across space and time; recognize the interdependence between water, energy, food and ecosystems; identify integrated policy solutions to optimize trade-offs and maximize synergies across sectors; ensure coordination across sectors and stakeholders; value the natural capital of land, water, energy sources and ecosystems.

At European level, there are many policies that, when regulating a specific area such as biodiversity, climate change, environment, energy, forestry, growth or agriculture mention actions that address one or more elements of the WEFE Nexus. The topics that emerge most frequently are: water quality, water infrastructure, water availability, water use, water stress, water for economic growth and sustainable development, water resource management; safe, sufficient and nutritious food, diversified local and regional food production, food security, food waste, nutrition, agro-ecological practices, agricultural productivity, sustainable food production; energy management, energy supply, energy efficiency, renewable energy generation, affordable and secure energy systems; land use planning, habitat conservation, and ecosystem protection.

However, only a few documents explicitly mention the Nexus in their action frameworks. For example, the Blueprint to Safeguard Europe's Water Resources of 2012 proposed the policy response to the challenges presented in the State of Water Report with the aim to ensure sufficient availability of good quality water for sustainable and equitable water use. When it refers to water for economic growth and sustainable development in chapter 2.6 it states that "*The EU will pay particular attention to the allocation and use of water in economic sectors, sustainable agriculture*

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

and the nexus water-agriculture-energy-environment" and, with regard to water governance, that "*adequate governance and sustainable water management at regional and transboundary levels also contribute to ensure peace and political stability via the water and security nexus*".

In the European Report on Development (May 2012) reference is made to the Water-Energy-Land Nexus and it is affirmed that "*An adequate response to emerging challenges, and specifically the linkages between water, energy and land, make it imperative to examine and manage the trade-offs not only among users and uses of the same resource, but also of other related resources*" emphasizing that "*the EU should consider water, energy and land from an integrated, ecosystems perspective*" and how it has to work "*to promote the integrated management of water, energy and land*" (p.14).

In the 2016, the Sustainable Energy Handbook published by the Commission's Directorate-General for International Cooperation and Development (DEVCO) a specific module on the Water-Energy-Food Nexus is presented and it is focused on the two main applications of the Nexus concept: "*the nexus concept for policy-making and as a framework for inter-sectorial dialogue; the nexus concept as a systematic framework to assess and chose among different interventions*".

The New European Consensus on Development at paragraph 25 states that "*The EU and its Member States will support the poorest communities in improving access for all to land, food, water, and clean, affordable and sustainable energy, while avoiding any damaging effects on the environment. They will promote policy initiatives and support partner countries in planning and implementing an integrated approach to concretely address the most relevant interlinkages between land, food, water and energy".* The document also highlights the link between the WEFE Nexus approach and the achievement of SDGs. Indeed, at Paragraph 19 it states that "*The implementation of the 2030 Agenda requires comprehensive national sustainable development strategies that factor in the SDGs and their interlinkages. When planning and implementing development cooperation, the EU and its Member States will pay particular attention to such interlinkages and to integrated actions that can create co-benefits and meet multiple objectives in a coherent way*".

Finally, in the DG-DEVCO Strategic Plan 2020-2024 (DG-DEVCO, 2020) the Theme 2 Climate Change, Environment, Energy states that: "*The focus will be on increasing the efficiency in the use of water resources, especially in the nexus with energy and agriculture*".

All these policy documents directly or indirectly contribute to the EU policy context for a WEFE Nexus approach in Europe.

At international level, the International Decade for Action on 'Water for Sustainable Development' 2018-2028 (resolution 71/222) makes direct reference to the Nexus highlighting "*the importance of promoting efficient water usage at all levels, taking into account the water, food, energy, environment nexus, including in the implementation of national development programmes*" and emphasizing that "*water is critical for sustainable development and the eradication of poverty and hunger, that water, energy, food security and nutrition are linked and that water is indispensable for*

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

human development, health and well-being and a vital element of achieving the Sustainable Development Goals and other relevant goals in the social, environmental and economic fields".

Finally, the EU program for Research and Innovation solutions in the Mediterranean region (PRIMA) includes a research area specifically oriented to the WEFE Nexus theme, which is described on the Program website as follows[1]: "*Integrated approaches will strengthen human, as well as water, energy and food security, environmental and climate security and contribute to the transition to green economy and achievements of SDGs and eventually also political security*".

3.1 NBS within international and European policies

The term NBS has seen its popularity growing over the past decade, along with the recognition of role of nature in providing a wide variety of benefits for human communities at local, regional and global level through sustainable socio-ecological systems (Dick *et al.*, 2019). The importance of NBS derives from their multifunctionality handy in sectoral interventions and policies: in fact, they are solutions that provide multiple environmental, social, and economic benefits, interlinking disaster risk reduction, climate change mitigation and adaptation, with restoration and protection of biodiversity and ecosystems.

Even though NBS is not a new concept, it was in the early 2000s that the term emerged. Initially intended as a nature-centered response to climate change problems (World Bank, 2008), it was supported by the World Conservation Union (IUCN) and, later, by the European Commission which recognized the need to coin a term that encompassed the various existing approaches. Indeed, NBS is an umbrella concept that comprises several terms, including ecosystem-based approaches, ecosystem-based adaptation, ecosystem-based disaster risk reduction, green infrastructure/blue and green infrastructure, and sustainable management/ecosystem-based management/sustainable forest management (Eisenberg *et al.*,2018; Ruangpan *et al.* 2020).

Today, the IUCN Global Standard for NBS provides a clear definition of NBS: "*Actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits*[2]*".* Alongside this definition The European Commission defines NBS as solutions that are *"inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience. Such solutions bring more, and more diverse, nature and*

[1] https://prima-med.org/what-we-do/nexus/

[2] https://www.iucn.org/our-work/nature-based-solutions

natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions[3]".

The terminology for referring to NBS in different international and European policy contexts still remains varied but the common denominator is that the use of nature-based strategies has the potential to strengthen ecosystem resilience, protect biodiversity, and reduce the risk of climate-related disasters, while at the same time addressing societal challenges and providing multiple benefits, such as climate change mitigation, human health and well-being, and moving towards sustainable development goals (Dumitru *et al.*, 2021).

Regarding the scope of policies related to biodiversity, water, and agriculture at the international level, the terms which have been used to refer to these kinds of solutions were conservation or ecosystem restoration, restoration initiatives, degraded land restoration, and sustainable use of ecosystems among others. More recently, the Post-2020 global biodiversity framework (2022) refers to NBS in Target 8 by reporting that "*Minimize the impact of climate change on biodiversity, contribute to mitigation and adaptation through ecosystem-based approaches, contributing at least 10 GtCO2e per year to global mitigation efforts, and ensure that all mitigation and adaptation efforts avoid negative impacts on biodiversity*". The Sendai Framework for Disaster Risk Reduction 2015–2030 (2015) in the chapter devoted to "Global and regional levels" suggests to "*promote transboundary cooperation to enable policy and planning for the implementation of ecosystem-based approaches with regard to shared resources, such as within river basins and along coastlines, to build resilience and reduce disaster risk, including epidemic and displacement risk*" paving the way to NBS as effective ecosystem-based tools for disaster risks reduction. Finally, priority 3 of the EU Action Plan for nature, people and the economy (2017) "*proposes ways to stimulate private investment and to better support connectivity between Natura 2000 areas, including through green infrastructure and nature-based solutions (Actions 8-12)*" and among the actions for strengthening investment in Natura 2000 and improving synergies with EU funding instruments it proposes to "*support nature-based solutions projects through EU research and innovation policy and Horizon 2020 fund*".

Within the **forest policy** domain, reference to NBS is made via terms/concepts such as sustainable management practices, afforestation, reforestation and other tree planting activities. The Agenda 2030 includes a variety of NBS and within SDG 15 on "Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss", the Targets 15.1, 15.3, 15.4, 15.A, 15.B refer to conservation and reforestation, sustainable use of ecosystems and biodiversity, and restore degraded lands.

[3] https://research-and-innovation.ec.europa.eu/research-area/environment/nature-based-solutions_en

At European level, in recent years references to NBS have started to become explicit and direct within **biodiversity-related policies**. For example, while biodiversity policies initially referred to concepts such as preservation, maintenance or restoration of habitats, starting from the Green Infrastructure Strategy (2013) they talk about Ecosystem-based approaches and NBS and in chapter 2.3 "investments in ecosystem-based disaster risk reduction and innovative risk management approaches" are promoted. Finally, the EU 2030 Biodiversity Strategy (2020) explicitly refers to NBS and to the need to "promote and facilitate partnerships, including a dedicated Biodiversity Partnership, to make the bridge between science, policy and practice and make nature-based solutions a reality on the ground" stressing that "the promotion of healthy ecosystems, green infrastructures and nature-based solutions should be systematically integrated into urban planning, including in public spaces, infrastructure, and their surroundings".

European **water-related policies** have begun to refer explicitly to NBS calling them Natural Water Retention Measures within the Blueprint to Safeguard Europe's Water Resources (2012). As for the **agriculture sector**, the term has been introduced with the Farm to Fork Strategy (2020) where it is suggested to: "*Make the best use of nature-based, technological, digital, and space-based solutions to deliver better climate and environmental results*". In recent times also **climate change-related policies** explicitly include the concept of NBS within the Climate change adaptation strategy (2021) in which there is a specific chapter devoted to NBS (2.2.4. Promoting nature-based solutions for adaptation) where it is stated that "*implementing nature-based solutions on a larger scale would increase climate resilience and contribute to multiple Green Deal objectives*". The European Climate Law confirms that "*In their national adaptation strategies, Member States shall take into account the particular vulnerability of the relevant sectors, inter alia, agriculture, and of water and food systems, as well as food security, and promote nature-based solutions and ecosystem-based adaptation. Nature-based solutions, in particular, can benefit climate change mitigation, adaptation and biodiversity protection*".

With regard to the **energy sector**, the first document that directly refers to the NBS concept is the Pact of Amsterdam (2016) which refers to the "*sustainable use of land and Nature-Based solutions*". A few years later, the 2018 EU Energy Performance of Buildings Directive suggested the use of "*solutions based on nature, such as well-planned street vegetation, green roofs and walls providing insulation and shade to buildings, contribute to reducing energy demand by limiting the need for heating and cooling and improving a building's energy performance*" and one year later the European Green Deal (2019) supported "*public and private investments on nature-based solutions for climate adaptation*". Finally, the Recovery and Resilience Facility (2021) draws attention to "*biodiversity, measures target the conservation of terrestrial and marine biodiversity, the restoration of ecosystems and green infrastructure, ecological connectivity based on nature-based solutions, sustainable forest management as well as the fight against invasive alien species*".

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

As for **cohesion and growth** policies, the Circular Economy Action Plan of 2015 directly mentions NBS reporting that: "*Carbon removals can be nature-based, including through restoration of ecosystems, forest protection, afforestation, sustainable forest management and carbon farming sequestration*. The European Regional Development Fund and the European Social Fund (2020) promote biodiversity, green infrastructure and preservation of nature, while the Strategic Plan 2020-2024 (2020) is "*aiming at bringing nature back into our lives, strengthening the work on nature-based solutions to protect ecosystems and integrate biodiversity into the broader landscape management, and reducing human-wildlife conflict, poaching and wildlife trafficking*."

In environmental policies, the terms conservation and sustainable use of biodiversity and ecosystems have been widely used while in recent times the reference to NBS is more explicit. For example, in chapter 3 of the New EU Forest Strategy to 2030 (2021) it is reported that: "*In light of climate change and biodiversity loss there is an urgent need for adaptive forest restoration and ecosystem-based management approaches*."

Finally, it is important to mention that under the research program Horizon 2020, NBS have been identified as an area for investment. For example, there have been funding areas supporting demonstration projects on NBS for climate and water resilience in cities (2016), on NBS for inclusive urban regeneration (2017); another funding area has supported large-scale demonstrators on NBS for hydro-meteorological risk reduction (2017). Also the LIFE programme has been addressing societal challenges through NBS like the project called "People-Driven: Adapting Cities for Tomorrow" (LIFE PACT) the aim of which is to "*develop and test an integrated approach to urban climate change adaptation that draws on the efforts of multiple stakeholders, including local government, citizens, universities and private actors, to more effectively implement Nature Based Solutions*".

An overview of the main policies considered for the aims of this reported is reported in Annex 1.

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

4. NBS policy and governance frameworks

In the last years the NBS concept has gained increasing visibility within the international and European policies, however their implementation in practice remains difficult and their potential under-expressed. To make policy effective, policy changes should be accompanied by an evolution of the institutional and governance environment within which policies are to be implemented (Maes and Jacobs, 2015). Managing NBS design and implementation is complex because NBS often involve multiple actions and effects that cross jurisdictional boundaries requiring active cooperation and coordinated actions among stakeholders whose priorities, interests, or values may not be aligned (Dale *et al.*, 2019). Moreover, decisions around costs, location, scale, and management of NBS involve a wide range of stakeholders with different ideas and previous ways of managing challenges which has to be matched (Nesshöver *et al.*, 2017). Some scholars claim that there are gaps in knowledge, particularly with regards to the cost-effectiveness of NBS compared to grey alternatives (e.g., Seddon *et al.*, 2020). Other possible barriers to NBS implementation are reported in Kabisch *et al.* (2016) by referring to "*the fear of operational unknown*", since NBS should be managed differently from other approaches and require new protocols for implementation and maintenance. Kabisch *et al.* (2016) also refer to the "*disconnect between short-term actions and long-term goals"* i.e., different decision-making and action cycles in terms of time and responsibilities for the maintenance of the project. Moreover, NBS projects require multifaceted domains of expertise that often do not fit into existing decision-making structures. NBS funding may also be a problematic issue. In fact, the availability of funds is often critical in the decision to implement a solution that has high costs (Harman *et al.*, 2013). However, obtaining funding can be difficult and it is accompanied by public and private decision-making processes that are unable to work with long-term intervention planning which involve a maintenance plan necessary to the delivery of NBS-related benefits (Kabisch *et al.*, 2016).

There are several policy and governance frameworks for the assessment of NBS and in particular to assess their efficiency and cost-effectiveness compared to more traditional approaches, as well as their suitability to the territories where they are implemented and finally to check that the environment for their design and implementation is conducive to their long-term operability with the aim of overcoming barriers preventing their use.

A first example is given by Martin *et al.* (2021) that developed a governance framework analyzing the NBS governance enablers "*defined as those processes, conditions, or factors that play a positive role in how government, market, and civil society actors or stakeholders organize to make policy decisions on NBS at different stages of their realization*" (p. 3).

The analysis was implemented in three case studies in Italy, Germany, and China selected for their success in realizing NBS for risk management (flood and landslides risk). The governance enablers were divided into six categories – i.e., political, socio-cultural, legal, financial, human resources, and

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

institutional – and distinguished into different stages of NBS development: preconditions, initiation, planning, design, and implementation. The study highlighted some important preconditions such as (among others) availability of funds, influential coalition groups, pressure groups, agents of change, a clear and robust legal basis which consists in legal documents useful to support NBS plans such as the Bavarian Constitution and Nature Conservation Act in the German case. Other relevant elements that have emerged include the presence of expert knowledge and technical expertise so that new and robust scientific evidence can be presented to support NBS, the multi-scale and cross-sectoral collaboration that breaks the typical structure of public administration characterized by distinct vertical areas of expertise and that supports collaboration and synergies of policymaking at diverse scales, relationship of trust among stakeholders, the mandate of the funding authorities on strengthening natural measures, strong political support. Many factors also emerge as critical to enable NBS project planning, design, and implementation. These include for example participatory co-design by actively engaging different stakeholders in NBS planning, independent government functions and financial resources which provide a strong level of flexibility in designing locally adaptive solutions, technical expertise, innovative engagement of local communities with consultation processes such as the Chinese case where the authorities have realized monetary incentives for households in consultation with villagers for community-based monitoring of illegal logging, limited funding availability which may direct the choice toward NBS over a more costly structural grey solution, pre-existing social norms and trust within the communities that facilitate their cooperation, revision of local regulations and a better integration of NBS into intermunicipal and cross-departmental goals, mutual cooperation.

Zingraff-Hamed *et al.* (2021) analyzed some NBS for flood risk management and mitigation implemented in Germany. What emerged is that most of the NBS they addressed are co-designed by a number of stakeholders from different geographic and legal levels, and that in most cases NBS implementation has been the result of collaborative planning involving stakeholders from single or multiple groups such as public sector actors, private sector players, NGO, and civil society representatives. The involvement of so many stakeholders can be justified by the equally large number of NBS goals and co-benefits (Zingraff-Hamed *et al.*, 2019). While collaborative, interdisciplinary, and interdepartmental governance approaches are critical for NBS implementation, the study also showed that local authorities play a crucial role in integrating NBS into planning strategies.

OECD environment policy paper no. 21 (OECD, 2020) focuses on how NBS can address water-related climate risk issues such as flooding and droughts and presents a policy evaluation framework addressing the assessment of enabling conditions for NBS implementation. Starting with a review of regulations and financial incentives at the national level that favor the use of NBS, the paper also highlights that, not only national public agencies play an important role in providing an enabling environment for NBS design, but many other public (including sub-national/local scale) as well as private actors are also involved in NBS implementation (Figure 2).

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

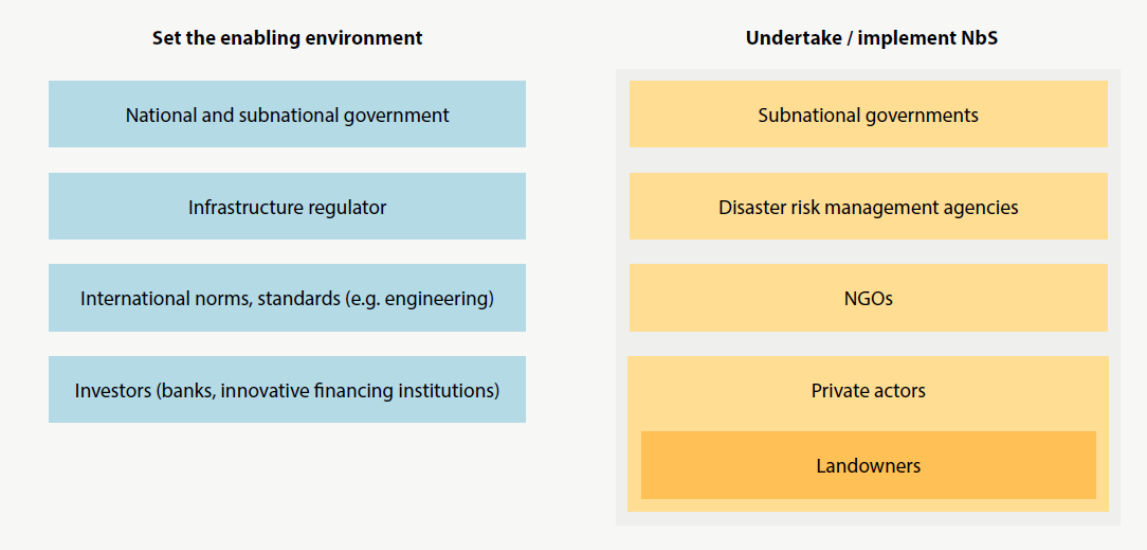

Figure 2. The role of different actors in NBS deployment. Source: OECD, 2021 p.18

In 2020 IUCN developed a global standard for NBS with 8 criteria and 28 indicators and a guide for using them. In addition to the focus on the actors involved in NBS design and implementation, the IUCN framework aims to support the assessment of good practices that can foster the use of NBS that find their way into high-level policy frameworks but that often lack in terms of implementation. Firstly, the framework addresses assessment needs on whether NBS can "fit" into existing planning and investment decision-making processes based on specific characteristics. Secondly, it identifies where and how these processes need to be adjusted to eliminate bias so that NBS can be considered on par with other options.

The framework consists of twenty key elements divided into different areas. These key elements are listed but not described. The framework is presented below (Table 1).

Table 1: OECD's policy evaluation framework for NBS

Areas	**Elements**
Good governance	Accountability for different aspects of NBS planning, implementation, and maintenance Coordination mechanisms (horizontal and vertical) Clear mandate and support for NBS.
Supportive policies	Consistency between sectoral policies and mechanisms to address trade-offs Encouragement of NBS within infrastructure planning processes Methodologies in place to measure benefits Inventory of existing natural capital/assets
Appropriate regulatory environment	Land use regulation and zoning Permitting Safety and performance codes and standards
	Procurement policies

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

Areas	Elements
	Land rights Environmental protection regulation
Technical capacity	Partnerships and information sharing Integration of NBS training into civil engineering and urban planning curricula Training and education
Finance	Availability of targeted incentives Ability to capture revenue streams Funding requirements Distribution of responsibilities

The IUCN has also developed a Global Standard for Nature-Based Solutions (2020). Organized into 8 criteria and 28 indicators, it helps the assessment of progress in NBS development and implementation. This is critical to increase the NBS scale and impact, to prevent unintended adverse effects or misuse, and help funding agencies, policymakers, and other stakeholders evaluate the effectiveness of interventions.

The **criterion 1** helps to define which societal challenge the NBS could support to develop a solution which meet the specific issue to solve. A single NBS can support different challenges. Important at this stage is for stakeholders to be involved and consulted to identify, understand and document the most pressing societal challenges to contribute to tangible and substantive benefits to human well-being (Table 2).

Table 2: Criterion 1 from IUCN Global Standard for NBS

Criterion	Indicators
1: NBS effectively address societal challenges	1.1 The most pressing societal challenge(s) for rights-holders and beneficiaries are prioritized
	1.2 The societal challenge(s) addressed are clearly understood and documented
	1.3 Human well-being outcomes arising from the NBS are identified, benchmarked and periodically assessed

The **criterion 2** states that the design of NBS is influenced by the scale. Indeed, an NBS will be implemented at a local scale, but it may have impacts at a larger scale. In NBS design it is therefore important to consider different systems interactions and risks into decision-making process to maintain the productive capacity of ecosystems and the benefits necessary for human well-being. Additionally, NBS design will be more effective if it seeks synergies and integration with other types of interventions and tools. All these aspects are reported in Table 3.

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

Table 3: Criterion 2 from IUCN Global Standard for NBS

Criterion	Indicators
2: Design of NBS is informed by scale	2.1 The design of the NBS recognizes and responds to interactions between the economy, society and ecosystems
	2.2 The design of the NBS is integrated with other complementary interventions and seeks synergies across sectors
	2.3 The design of the NBS incorporates risk identification and risk management beyond the intervention site

Criteria 3, 4, and 5 concern sustainable environmental, economic, and social actions. Indeed, NBS implementation must ensure the preservation of biodiversity and ecosystems by enhancing their functionality and guaranteeing the long-term resilience and durability of NBS. An accurate assessment of the state of the ecosystem, possible losses and improvements produced by NBS will therefore be necessary by setting clear objectives and monitoring their progress. This can be assessed through indicators listed under **Criterion 3** (Table 4).

Table 4: Criterion 3 from IUCN Global Standard for NBS

Criterion	Indicators
3: NBS result in a net gain to biodiversity and ecosystem integrity	3.1 The NBS actions directly respond to evidence-based assessment of the current state of the ecosystem and prevailing drivers of degradation and loss
	3.2 Clear and measurable biodiversity conservation outcomes are identified, benchmarked and periodically assessed
	3.3 Monitoring includes periodic assessments of unintended adverse consequences on nature arising from the NBS
	3.4 Opportunities to enhance ecosystem integrity and connectivity are identified and incorporated into the NBS strategy

Criterion 4 deals with economic sustainability aspects concerning the feasibility of the intervention, the long-term economic return, and the efficiency and effectiveness of the NBS. Therefore, it will be important to implement a cost benefit analysis and identify who receives the benefits and who bears the costs considering different available solutions and different financing options. The evaluation may be carried out according to the indicators presented in Table 5.

Table 5: Criterion 4 from IUCN Global Standard for NBS

Criterion	Indicators
4: NBS are economically viable	4.1 The direct and indirect benefits and costs associated with the NBS, who pays and who benefits, are identified and documented
	4.2 A cost-effectiveness study is provided to support the choice of NBS including the likely impact of any relevant regulations and subsidies
	4.3 The effectiveness of the NBS design is justified against available alternative solutions, taking into account any associated externalities
	4.4 NBS design considers a portfolio of resourcing options such as market-based, public sector, voluntary commitments and actions to support regulatory compliance

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

Criterion 5 emphasizes inclusiveness, transparency, and the empowering governance processes through the involvement of communities, stakeholders, and their knowledge. In practice, this criterion requires that NBS involve and represent the interests of different stakeholders including traditionally excluded categories or groups from different jurisdictions who can actively operate through feedback and grievance resolution mechanisms, who are involved in all stages of the NBS intervention process, and who are informed by transparent and accessible documentation. This dimension is captured through the indicators listed in Table 6.

Table 6: Criterion 5 from IUCN Global Standard for NBS

Criterion	Indicators
5: NBS are based on inclusive, transparent and empowering governance processes	5.1 A defined and fully agreed upon feedback and grievance resolution mechanism is available to all stakeholders before an NBS intervention is initiated 5.2 Participation is based on mutual respect and equality, regardless of gender, age or social status, and upholds the right of Indigenous Peoples to Free, Prior and Informed Consent (FPIC) 5.3 Stakeholders who are directly and indirectly affected by the NBS have been identified and involved in all processes of the NBS intervention 5.4 Decision-making processes document and respond to the rights and interests of all participating and affected stakeholders 5.5 Where the scale of the NBS extends beyond jurisdictional boundaries, mechanisms are established to enable joint decision-making of the stakeholders in the affected jurisdictions

Criterion 6 ensures that NBS equitably balance trade-offs between the achievement of their primary goal(s) and the continued provision of multiple benefits. The criterion requires that NBS proponents, recognizing trade-offs, adopt a stakeholder agreement for a fair, transparent and inclusive process that balances them over time and space as shown by the indicators selected and included under the criterion 6 (Table 7).

Table 7: Criterion 6 from IUCN Global Standard for NBS

Criterion	Indicators
6: NBS equitably balance trade-offs between achievement of their primary goal(s) and the continued provision of multiple benefits	6.1 The potential costs and benefits of associated trade-offs of the NBS intervention are explicitly acknowledged and inform safeguards and any appropriate corrective actions
	6.2 The rights, usage of and access to land and resources, along with the responsibilities of different stakeholders, are acknowledged and respected
	6.3 The established safeguards are periodically reviewed to ensure that mutually agreed trade-off limits are respected and do not destabilize the entire NBS

Criterion 7 suggests that NBS implementation plans include adaptive management in response to uncertainty as an option to effectively harness ecosystem resilience through the evaluation and monitoring of the strategic actions implemented that drive the iterative -learning process. The indicators follow the foundation of adaptive management (Table 8).

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

Table 8: Criterion 7 from IUCN Global Standard for NBS

Criterion	Indicators
7: NBS are managed adaptively, based on evidence	7.1 A NBS strategy is established and used as a basis for regular monitoring and evaluation of the intervention
	7.2 A monitoring and evaluation plan is developed and implemented throughout the intervention lifecycle
	7.3 A framework for iterative learning that enables adaptive management is applied throughout the intervention lifecycle

Finally, **criteria 8** suggests that NBS are sustainable and mainstreamed within an appropriate jurisdictional context that allows for interventions designed and managed with a view to long-term sustainability and aligned with the policies of interest. This will allow the replicability of the intervention, its expansion in terms of geography, sector and policy, and will enable the achievement of national and international goals as made explicit by the indicators (Table 9).

Table 9: Criterion 8 from IUCN Global Standard for NBS

Criterion	Indicators
8: NBS are sustainable and mainstreamed within an appropriate jurisdictional context	8.1 The NBS design, implementation and lessons learnt are shared to trigger transformative change
	8.2 The NBS informs and enhances facilitating policy and regulation frameworks to support its uptake and mainstreaming
	8.3 Where relevant, the NBS contributes to national and global targets for human well-being, climate change, biodiversity and human rights, including the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP)

5. Policy and governance indicators for a good NBS implementation

The intent of the work done was to develop an evaluation framework capable of assessing how well policy and governance conditions are conducive to the implementation and success of an NBS project. The framework consists of key dimensions, key elements, and associated indicators (Annex 2). A variable score captures the degree of optimality for policy and governance environment (Annex 3).

The development of the framework started from the key dimensions and key elements reported by OECD (2021), enriching them with other dimensions and key elements from other works and using some criteria reported by IUCN (2020) translated into new key elements or new dimensions and associated with IUCN (2020) indicators, governance indicators reported in other studies and newly developed indicators.

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

The **first key dimension** is "Conducive governance arrangements" (Table 10), taken from the OECD (2021) framework. By this dimension OECD refers to the need to structure actions that coordinate different policy areas and public authorities potentially involved in NBS deployment and financing. Three key elements are associated to this dimension: responsibilities for different aspects of NBS phases (planning, implementation, and maintenance); coordination mechanisms (horizontal and vertical); stakeholder endorsement. The first key element is taken from the OECD (2021) framework and consists of two indicators: "clearly defined structure and roles" that is the presence of dedicated actors for NBS planning, implementation, and maintenance; and "NBS responsibilities" which suggests the predisposition of well-defined actors' responsibilities for each NBS phases. The second key element is also taken from the OECD (2021) framework and consists of six indicators: "participation in all processes of the NBS intervention" draws on indicators reported in Da Re (2012) and points out the importance of using the participatory approaches in decision-making in all the phases of NBS intervention; "equity in participatory processes" indicator takes inspiration from IUCN's (2020) indicator 5.2 and covers the participation based on mutual respect and equity, regardless of gender, age or social status, and the right of Indigenous Peoples to Free, Prior and Informed Consent (FPIC); "represented stakeholders" indicator is based on the IUCN's (2020) indicator 5.3 and refers to identification and involvement of direct and indirect stakeholders affected by the NBS; "represented interest of stakeholders" indicator recalls to the IUCN's (2020) indicator 5.4 and is interpreted as the necessity that the decision-making processes document and respond to the rights and interests of all participating and affected stakeholders. An application example of these indicators is the "dreaming" exercise carried out by Commons Lab in Antwerp in 2017[4]. Collaborative work was carried out between authorities and citizens of the Sint Andries district to co-create and implement a green corridor connecting different NBS for water security. People with different backgrounds and skills were involved in this experiment from which their specific visions were gathered. The shared ideation and narrative work around NBS triggered changes in the way citizens perceive local institutions and led to a strong sense of belonging and responsibility for NBS by the actors involved in the experiment. The final two indicators "intra-organizational coordination" and "inter-organizational coordination" are based on Da Re (2012) indicators and are understood as the presence of coordination mechanisms among NBS stakeholders (e.g., public institutions, economic bodies, stakeholders) as reported in Kabisch *et al.* (2016) and where the scale of the NBS extends beyond jurisdictional boundaries, mechanisms are established to enable joint decision-making of the stakeholders in the affected jurisdictions (Zingraff-Hamed *et al.*, 2020). The paper by Lupp *et al.* (2021) reports the examples of the restoration of the Isar River in Munich and the Mountain Forest Initiative ("*Bergwaldoffensive*") in the Bavarian Alps. In these cases, the implementation of NBS leveraged an intensive collaborative planning process called Living Labs that allowed the most interested stakeholders to play a leverage role in the planning processes. The success of these initiatives was dictated by the broad

[4] https://commonslab.be/what-is-commons-lab

involvement of civil society, the open-mindedness of administrations, and the atmosphere of trust among stakeholders. The third key element has been suggested by relevant criteria in the MCA of Infrastructure projects (Infrastructure Australia, 2021) and it is articulated in two indicators: "Community supporting the NBS", discussed in literature as critical element for successful NBS (Martin *et al.*, 2021; Wuijts *et al.*, 2018) and which here makes explicit the need that NBS achieve a high level of support from the community; "Management of the negative impacts' strategy" is reported as criteria for infrastructure projects (Infrastructure Australia, 2021) and here means presence and use of instruments to manage the negative impacts affecting stakeholders.

Table 10: First key dimension – Conducive governance arrangements

#	Key dimension	##	Key elements	###	Indicators
1	CONDUCIVE GOVERANCE ARRANGEMENTS	1	Responsibilities for different aspects of NbS phases (planning, implementation and maintenance)	1	Clearly defined structure and roles
				2	NBS responsibilities
		2	Coordination mechanisms (horizontal and vertical)	1	Participation in all processes of the NBS intervention
				1.1	Equity in participatory processes
				1.2	Represented stakeholders
				2	Represented interest of stakeholders
				3	Intra-organisational coordination
				4	Inter-organisational coordination
		3	Stakeholder endorsement	1	Community supporting the NBS
				2	Management of the negative impacts' strategy

The **second key dimension** is "Supportive policies" (Table 11), taken from the OECD (2021) framework. By this expression, the OECD refers to the need of "*clear mandates from the highest policy level*" because they "*have the potential to accelerate NBS uptake*" and that "*different sectoral policies encourage NBS adoption*". Accordingly, the key elements, all taken up by OECD (2021), are: "clear mandate and support for NBS" with the related indicator "European, national and sub-national policies supporting NBS"; "coherence between sectoral policies, and mechanisms to address trade-offs" with the associated indicator "European, national and sub-national policies' objectives"; "encouragement of NBS within infrastructure planning processes" linked to the indicator "indication of NBS as planning options". What the three indicators refer to is the possibility of investigating how supportive policy frameworks are of NBS planning and use as suggested and realized by European Commission (2021) and in Davis *et al.* (2017).

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

Table 11: Second key dimension – Supportive policies

#	Key dimension	##	Key elements	###	Indicators
2	SUPPORTIVE POLICIES	1	Clear mandate and support for NbS	1	European, national and sub-national policies supporting NBS
		2	Coherence between sectoral policies, and mechanisms to address trade-offs	1	European, national and sub-national policies' objectives
		3	Encouragement of NbS within infrastructure planning processes	1	Indication of NBS as planning options

The **third key dimension** "Supporting policies" (Table 12) was developed and introduced from the IUCN (2020) indicators 8.2 (The NBS informs and enhances facilitating policy and regulation frameworks to support its uptake and mainstreaming) e 8.3 (Where relevant, the NBS contributes to national and global targets for human well-being, climate change, biodiversity, and human rights, including the United Nations Declaration on the Rights of Indigenous Peoples). So, the key elements derived are "Encouragement of NBS adoption towards its positive outcomes" and "Methodologies in place for measuring NBS contribution". The corresponding indicators are "Implementation of a successful NBS" intended as the NBS facilitates policy and regulation frameworks to support its uptake and mainstreaming; and "Contribution of NBS to national and global targets" as the presence of procedures capturing the NBS contribution to national and global targets for human well-being, climate change, biodiversity, and human rights. Indeed, the benefits from adopting NBS can contribute to the achievement of broader goals. A practical example is the NEMA (National Environment Management Authority)'s project "Nature-Based Solutions for environmental integrity, climate resilience and sustainable livelihood in Uganda". The project aims to improve at ecosystems functionality for sustainable ecosystems goods and services for both environmental integrity and human survival (health and life-support systems); climate resilience through ecosystems-based adaptation and mitigation actions; and community empowerment through access to natural resources for food security and household income, thus contributing to the sustainable development goal 1 "zero poverty", goal 2 "zero hunger", goal 5 "gender equality", goal 12 "climate action", goal 15 "life on land".

Table 12: Third key dimension – Supporting policies

#	Key dimension	##	Key elements	###	Indicators
3	SUPPORTING POLICIES	1	Encouragement of NBS adoption towards its positive outcomes	1	Implementation of a successful NBS
		2	Methodologies in place for measuring NBS contribution	1	Contribution of NBS to national and global targets

The **fourth key dimension** "Appropriate regulatory environment" (Table 13) is taken from OECD (2021) with all its six key elements which are: "Land-use regulation and zoning", "Permitting", "Safety and performance codes and standards", "Procurement policies", "Land rights", "Environmental protection regulation". The indicator related to the first key element is "Land use

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

designation" intended as presence of documents defining the land use of the area (e.g., maps, regulations) useful in defining areas for NBS implementation; the indicator for the second key element is "Clear and defined construction permits" meant as presence of needed authorizations to implemented the selected NBS; the indicator for the third key element is "Clear and defined safety and performance codes and standards" intended as presence of a comprehensive set of interconnected regulations that are designed to regulate that NBS design and construction are sound and will hold up to the rigors of nature and time; the indicator for the fourth key element is "Clear procurement policies "intended as core policies and standards and define the procedures to follow to ensure effective and compliant procurement practice. Proceeding, we meet the key element "Land rights" which is accompanied by two indicators: "Clear land and resources tenure, usage, and access rights which define how access is granted to rights to use, control, and transfer land and resources, as well as associated responsibilities and restraints. ; and "Acknowledge and observance of the land and resources tenure, usage, and access rights" so that the NBS implementation does not infringe on anyone's rights but can produce benefits for different stakeholders in the area involved by the intervention. However, as reported in the analysis of Zingraff-Hamed *et al.* (2021), in many cases NBS projects benefit from already having some land available for use. Finally, the sixth key element is linked to the indicator "Clear environmental protection regulation" to ensure real effectiveness in terms of environmental improvement and protection through the NBS adoption.

Table 13: Fourth key dimension – Appropriate regulatory environment

#	Key dimension	##	Key elements	###	Indicators
4	APPROPRIATE REGULATORY ENVIRONMENT	1	Land-use regulation and zoning	1	Land use designation
		2	Permitting	1	Clear and defined construction permits
		3	Safety and performance codes and standards	1	Clear and defined safety and performance codes and standards
		4	Procurement policies	1	Clear procurement policies
		5	Land rights	1	Clear land and resources tenure, usage, and access rights
				2	Acknowledge and observance of the land and resources tenure, usage, and access rights
		6	Environmental protection regulation	1	Clear environmental protection regulation

The **fifth key dimension** is reported in OECD (2021) as "Technical capacity", intended as the skills and knowledge needed to identify and implement an NBS (Table 14). The first key element is "Partnerships and information sharing" whose indicators take their cue from those of Da Re (2012): "Stakeholders' network cohesion to optimize interdisciplinary co-creation and co-design of NBS" intended as exchange of information (by phone, mail, letter, personally) among stakeholders

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

regarding NBS project; and "Procedures for collecting comments" that is the use of formal procedures to allow stakeholders to provide their contributes before and during the NBS intervention. Both indicators ensure that a sense of ownership and involvement around the project is strengthened, ensuring its success (Kabisch *et al.*, 2016; Zingraff-Hamed *et al.*, 2021). The second key element is "Integration of NBS training in civil engineering and urban planning curricula" whose indicator "Training in NBS" suggests the presence of specific NBS course to improve NBS adoption (to engineers, planners' bodies of public administration) or NBS-related education (in university curricula) to fill gaps inherent in these new solutions and open the vision toward different possible scenarios. The third key element "Training and education" presents two indicators which recalls some of Da Re (2012) indicators which are: "Collaborative leaning among stakeholders" intended as presence of bidirectional flows of collaborative learning among stakeholders helping anticipate which policies are likely to be effective (Cashore *et al.*, 2019); and "Knowledge courses" which refers to the possibility that the lead organization designs specializing courses open to residents and stakeholders so as to make them more involved and aware of the experience they will be called to live in their territories.

Table 14: Fifth key dimension – Technical capacity

#	Key dimension	##	Key elements	###	Indicators
5	TECHNICAL CAPACITY	1	Partnerships and information sharing	1	Stakeholders' network cohesion to optimize interdisciplinary co-creation and co-design of NbS
				2	Procedures for collecting comments
		2	Integration of NbS training in civil engineering and urban planning curricula	1	Training in NBS
		3	Training and education	1	Collaborative leaning among stakeholders
				2	Knowledge courses

The **sixth key dimension** taken from OECD (2021) is "Access to finance" (Table 15). In fact, as mentioned earlier, limited access to appropriate funding is often reported as an important barrier to the NBS implementation. Therefore, a redirection of funds to support NBS and standardized funding models would be needed. The key elements taken from OECD (2021) has their associated indicators: "Availability of targeted incentives" element has the indicator "European, national and sub-national resourcing options (policies, financial instruments, etc.) supporting NBS" which refers to the availability of a portfolio of resourcing options for NBS at different scales that public administrators and policymakers can rely on; the key element "Ability to capture revenue streams" has associated the indicator "Completeness of income sources" indicating the presence of professional project design team and complete project management system capable of securing specific work for obtaining funding (search of calls for founding, project writing, reporting etc.); the "Financing requirements" element has the indicator "Financial sustainability" that is the presence

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

of professional project design team and complete project management system; finally, the key element "Distribution of liabilities" has the associated indicator "Legal responsibilities" which refers to the need to include and structure specific responsibilities for each legal entity involved in the project (individual citizens, associations, public administrations).

Table 15: Sixth key dimension – Access to finance

#	Key dimension	##	Key elements	###	Indicators
6	ACCESS TO FINANCE	1	Availability of targeted incentives	1	European, national and sub-national resourcing options (policies, financial instruments, etc.) supporting NBS
		2	Ability to capture revenue streams	1	Completeness of income sources
		3	Financing requirements	1	Financial sustainability
		4	Distribution of liabilities	1	Legal responsibilities

The **seventh key dimension** is "NBS management" (Table 16) and related key elements that were developed from IUCN (2020) criteria made explicit in some of its indicators. The key element "NBS monitoring" has a first indicator "Monitoring and evaluation strategy" which takes up to the IUCN (2020) indicators 3.3 (Monitoring includes periodic assessment), 7.1 (A NBS strategy is established and used as a basis for regular monitoring and evaluation of the intervention), and 7.2 (A monitoring and evaluation plan is developed and implemented throughout the intervention lifecycle). Here, the indicator is defined as the presence and use of strategies to periodically monitor and evaluate the NBS intervention throughout its lifecycle so that the project can be recalibrated and modified if necessary. The second indicator "Adaptive NBS intervention management" recalls the IUCN's (2020) indicator 7.3 (A framework for iterative learning that enables adaptive management is applied throughout the intervention lifecycle) and it is identified in the presence and use of regular monitoring and evaluation, using both scientific knowledge and knowledge from tradition and local people. This ensures that NBS can continue to be effective throughout the intervention, minimizing the risk of redundancy and inappropriate investments.as it happened for the 300,000 hectares restored project in Shinyanga, Tanzania started in 1985 (E. Barrow, 2014). The second key element "NBS safeguard" and its first indicator "NBS safeguard system" resume concepts from the IUCN (2020) indicator 6.3 (The established safeguards are periodically reviewed to ensure that mutually agreed trade-off limits are respected and do not destabilize the entire NBS). Here the indicator is intended as the presence and use of a system to ensure that mutually agreed trade-off limits are respected and do not destabilize the entire NBS intervention. It will be necessary to make explicit in the NBS design and strategy what the benefits and costs will be (including when and how they will be reviewed) considering that the unfairness of trade-offs may change over time and that not all stakeholders may be equally affected as in the case of Hilsa Conservation Programme in Bangladesh (Reid and Ali, 2019). The second indicator takes up some relevant criteria presented in Infrastructure Australia (2021), intended as presence of criteria that analyze the potential risks' type and level of each option and the available means to reduce them.

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

Table 16: Seventh key dimension – NBS management

7	NBS MANAGEMENT	1	NBS monitoring	1	Monitoring and evaluation strategy
				2	Adaptive NBS intervention management
		2	NBS safeguard	1	NBS safeguard system
				2	Risk strategy

Each indicator has been assigned a scoring scale that will support the assessment of existing policy and governance conditions, revealing the extent to which they facilitate and support the NBS project and pointing toward the most favorable options.

In the following box (Box 1) is described the role that some working packages of the LENSES project could have in contributing to the implementation of the indicators.

Box 1: Support data collection

SUPPORT DATA COLLECTION

Within the LENSES project, the work elaborated by some partners within different work packages (e.g., WP3 and WP4) can support the use of some indicators proposed in the framework. In particular, some metrics form Social Network Analysis can support the implementation of various indicators.

For example, the indicator 1.1.1 can be supported by selected metrics that can be used to characterize the structure of agents involved in NBS planning, implementation and management and to identify barriers or bottlenecks. About the indicator 1.1.2, other metrics can be used to characterize how the structure of agents involved in NBS planning, implementation, and management changes in different phases. Some metrics can also be used in relation to indicators 1.2.1 and 1.2.1.2 to characterize how the community (or selected agents) are connected to other agents. The indicators 1.2.3 and 1.2.4 can be supported by some metrics used to characterize the level of coordination among agents in the flow of information and/or in the completion of tasks. Scenario analysis performed through participatory system dynamics modelling (PSDM) can help in assessing indicator 1.3.1 and the level of community support achieved by NBS. Finally, some metrics from Social Network Analysis can also be supportive for the indicators 5.1.1 and 5.3.1 characterizing the flow of information between stakeholders involved in NBS projects.

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

6. Framework user guide

This chapter aims to provide instructions on the use of the framework to promote its application and circulation among the LENSES pilots and potential final users.

The framework is organized into seven different dimensions enabling NBS projects. Each dimension is further defined and described via different key elements. Both the dimensions and the key elements are then associated to specific indicators that are to be assessed in terms of presence/compliance (1) or absence (0) (Annex 3).

The setting given to the excel file allows individual indicators or the average of sub-indicators to be displayed with different colors based on a scoring scale (Table 17).

Table 17: Ratio underling the scoring scale

0	0.10		Red colour means that the condition reported by the indicator is almost absent
0.11	0.49		Orange means that the condition reported by the indicator is sparsely present
0.50	0.89		Yellow means that the condition reported by the indicator is sufficiently present
0.90	1		Green means that the condition reported by the indicator is mostly present

The score associated to each indicator contributes to determine the score of the corresponding key elements and key dimensions. Each indicator has been weighted according to its importance in contributing to the corresponding key element. The result at key element level is given by the weighted average with respect to the importance associated with each indicator. For this, the above-mentioned scoring and color scale are maintained. Similarly, each key element contributes to determine the score of the corresponding key dimension. Each key element has been weighted and the final score at key dimension scale corresponds to corresponds to an average value referring to the same color scale used for indicators and key elements. Weights were assigned to indicators and key elements based on existing literature and through validation by the research team and experts (Table 18).

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

Table 18: Scoring scale for policy and governance framework

#	Key dimension	##	Key elements	Element Weight	###	Indicators	Indicator Weight	Description	Sub-indicator	Scoring
1	CONDUCIVE GOVERNANCE ARRANGEMENTS	1	Responsibilities for different aspects of NbS phases (planning, implementation and maintenance)	25%	1	Clearly defined structure and roles	50%	Dedicated actors for NBS planning, implementation, and maintenance	Planning	[0/1]
									Implementation	[0/1]
									Maintainence	[0/1]
					2	NBS responsibilities	50%	Well defined actors' responsibilities for each NBS phases	Planning	[0/1]
									Implementation	[0/1]
									Maintainence	[0/1]
		2	Coordination mechanisms (horizontal and vertical)	50%	1	Participation in all processes of the NBS intervention	20%	Use of participatory approaches in decision-making in all the phases of NBS intervention	Planning	[0/1]
									Implementation	[0/1]
									Maintainence	[0/1]
					1.1	Equity in participatory processes	2%	The participation is based on mutual respect and equity, regardless of gender, age or social status, and upholds the right of Indigenous Peoples to Free, Prior and Informed Consent (FPIC)	gender	[0/1]
									age	[0/1]
									social status	[0/1]
									indigenous right	[0/1]
					1.2	Represented stakeholders	3%	Identification and involvement of direct and indirect stakeholders affected by the NBS		[0/1]
					2	Represented interest of stakeholders	25%	The decision-making processes documents and responds to the rights and interests of all participating and affected stakeholders		[0/1]
					3	Intra-organisational coordination	25%	Presence of coordination mechanisms among NBS stakeholders (e.g., public institutions, economic bodies, stakeholders)		[0/1]
					4	Inter-organisational coordination	25%	Where the scale of the NbS extends beyond jurisdictional boundaries, mechanisms are established to enable joint decision-making of the stakeholders in the affected jurisdictions		[0/1]
		3	Stakeholder endorsement	25%	1	Community supporting the NBS	50%	The NBS achieves a high level of support from the community		[0/1]
					2	Management of the negative impacts'	50%	Presence and use of instruments to manage the negative impacts affecting		[0/1]
2	SUPPORTIVE POLICIES	1	Clear mandate and support for NbS	25%	1	European, national and sub-national policies	100%	Reference to NBS		[0/1]
		2	Coherence between sectoral policies, and mechanisms to address trade-offs	25%	1	European, national and sub-national policies' objectives	100%	Absence of conflicting objectives among the sectoral policies		[0/1]
		3	Encouragement of NbS within infrastructure planning processes	50%	1	Indication of NBS as planning options	100%	Mention of NBS within the land use planning regulations, strategies, and plans	land use planning regulations	[0/1/NA]
									strategies	[0/1/NA]
									plans	[0/1/NA]

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

3	SUPPORTING POLICIES	1	Encouragement of NBS adoption towards its positive outcomes	50%	1	Implementation of a successful NBS	100%	The NbS facilitates policy and regulation frameworks to support its uptake and mainstreaming	uptake	[0/1/NA]
									mainstreraming	[0/1/NA]
		2	Methodologies in place for measuring NBS contribution	50%	1	Contribution of NBS to national and global targets	100%	Presence of procedures capturing the NBS contribution to national and global targets for human well-being, climate change, biodiversity and human rights.	human well-being	[0/1/NA]
									climate change	[0/1/NA]
									biodiversity	[0/1/NA]
									human rights	[0/1/NA]
4	APPROPRIATE REGULATORY ENVIRONMENT	1	Land-use regulation and zoning	16%	1	Land use designation	100%	Presence of documents defining the land use of the area (e.g., maps, regulations)		[0/1]
		2	Permitting	16%	1	Clear and defined construction permits	100%	Presence of needed permits to implement the selected NBS		[0/1]
		3	Safety and performance codes and standards	16%	1	Clear and defined safety and performance codes and	100%	Presence of codes and standards needed to implement the selected NBS (e.g., safety, ...)		[0/1]
		4	Procurement policies	16%	1	Clear procurement policies	100%	Presence of policies		[0/1]
		5	Land rights	20%	1	Clear land and resources tenure, usage, and access	100%	Existence of well-defined land resources tenure, usage, and access rights	tenure	[0/1/NA]
									usage	[0/1/NA]
									access right	[0/1/NA]
					2	Acknowledge and observance of the land and resources tenure, usage, and access	100%	The tenure, usage of and access rights to land and resources, along with the responsibilities of different stakeholders, are acknowledged and respected	tenure	[0/1/NA]
									usage	[0/1/NA]
									access right	[0/1/NA]
		6	Environmental protection regulation	16%	1	Clear environmental protection regulation	100%	Presence of compliance environmental protection regulation		[0/1]

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

5	TECHNICAL CAPACITY	1	Partnerships and information sharing	40%	1	Stakeholders' network cohesion to optimize interdisciplinar	80% (70)	Exchange of information (by phone, mail, letter, personally) among stakeholders regarding NBS project		[0/1]
					2	Procedures for collecting comments	20% (30)	Use of formal procedures to allow stakeholders to provide their comments/contributes before and during the NBS intervention	before	[0/1]
									during	[0/1]
		2	Integration of NbS training in civil engineering and urban planning curricula	25%	1	Training in NBS	100%	Presence of specific NBS course to improve NBS adoption (to engineers, planners' bodies of public administration) or NBS-related education (in university curricula)	course	[0/1]
									education	[0/1]
		3	Training and education	35%	1	Collaborative leaning among stakeholders	50%	Presence of bidirectional flows of collaborative learning among stakeholders		[0/1]
					2	Knowledge courses	50%	The lead organization organizes specializing courses open to residents and stakeholders	residents	[0/1]
									stakeholders	[0/1]
6	ACCESS TO FINANCE	1	Availability of targeted incentives	25%	1	European, national and sub-national resourcing options	100%	Availability of a portfolio of resourcing options for NBS		[0/1]
		2	Ability to capture revenue streams	25%	1	Completeness of income sources	100%	Presence of professional project design team and complete project management system	design team	[0/1]
									management system	[0/1]
		3	Financing requirements	25%	1	Financial sustainability	100%	Presence of professional project design team and complete project management system	design team	[0/1]
									management system	[0/1]
		4	Distribution of liabilities	25%	1	Legal responsibilities	100%	Well defined legal responsibilities related to NBS implementation		[0/1]
7	NBS MANAGEMENT	1	NBS monitoring	50%	1	Monitoring and evaluation strategy	50%	Presence and use of strategies to periodically monitor and evaluate the NBS intervention throughout its lifecycle		[0/1]
					2	Adaptive NBS intervention management	50%	Presence and use of iterative learning process that enables an adaptive NBS intervention management throughout its lifecycle		[0/1]
		2	NBS safeguard	50%	1	NBS safeguard system	50%	Presence and use of a safeguard system to ensure that mutually-agreed trade-off limits are respected and do not destabilise the entire NBS		[0/1]
					2	Risk strategy	50%	Presence of strategies that allow the identification and management of possible risks' type and level		[0/1]

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

To support the work of the pilots, an excel file (Annex 3) was created in which by entering the presence (1) or absence (0) of the aspect detected by the indicator it will be possible for the pilots to visualize and identify gaps that need attention and require future action to create more favorable conditions for the implementation of the selected NBS in the given context.

It is finally important to underline that regarding the **second key dimension** "Supportive policies" and the key element "Clear mandate and support for NBS" the 1/0 score refers to the presence (1) or absence (0) of a Policy analysis table as proposed in Chapter 3. The approach to be used to address this dimension is summarized below:

1. Identify key policy documents (laws, regulations, rules, strategies) at national and sub-national levels for the following thematic areas: biodiversity, forests, agriculture, environment, climate change, energy, water, growth and development, and research.

2. Search within each document for specific reference to the elements of the WEFE Nexus using keywords like water, food, agriculture, energy, ecosystems, habitat, and environment. Also check whether there is an explicit reference to the WEFE Nexus or to the link of interdependence between its elements.

3. Search within each document for a reference to the adoption of NBS. Key terms included within the umbrella concept of NBS can be used as references, e.g., ecosystem-based approaches, ecosystem-based adaptation, ecosystem-based disaster risk reduction, green infrastructure/blue infrastructure, and green infrastructure/ecosystem-based management/sustainable forest management, conservation/maintenance or restoration of habitats and ecosystems.

4. Once the references have been found read the corresponding part of text and identify whether it is relevant or not, i.e., whether it refers to the WEFE-Nexus (or NBS) or not. If relevant, use the information in the text to fill a database containing: the name of the policy document within its subject area; the year of issuance; the presence of one or more elements of the WEFE Nexus (W for water; E for energy; F for food; ES for ecosystem) or an explicit reference to it (Nexus); key words or short phrases directing the Nexus or one or more of its components; the reference where to find these directions (chapter, article, page, etc.); key words or short phrases involving the use of NBS; the reference where to find them (chapter, article, page, etc.); the link to the source of the document.

As an example, an extract from the policy analysis table is reported in Table 19. The one presented is an initial attempt that could be updated once implemented by the pilots and when users will report any possible improvements.

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

Table 19: Example of the policy analysis table

Policy field	International policy	Year	WEFE component	WEFE Reference	WEFE key words	NBS Reference	NBS key words	Source
Climate Change	Sendai Framework for Disaster Risk Reduction 2015-2030	2015	F	Priority 2: 28, b; Priority 3: 30, j; Priority 4:33, h	Food and nutrition/ food security/ essential food relief supplies	Priority 2: 28.d	To promote transboundary cooperation to enable policy and planning for the implementation of **ecosystem-based approaches**	https://www.preventionweb.net/files/43291_sendaiframeworkfordrren.pdf
			W	Priority 4: 33, c; Priority 4: 34, e;	Water-related disaster risk; water transportation infrastructure			

7. Framework validation

Experts in the field of environmental policy and governance were involved in a preliminary assessment and validation round of the framework and the associated indicators. Feedback from experts were considered and, when relevant, incorporated into the framework.

The revised version of the framework was then shared with the pilots to investigate if, according to them, the tool developed could be useful, easy to use and effective. For each indicator, pilots were invited to address the following questions:

1. Is the indicator useful?
2. Is the indicator clear?
3. Does the indicator consider aspects that you already thought to evaluate in your pilot?
4. Does the indicator suggest aspects that you have not taken into consideration in your pilots yet?
5. Would you be able to implement the indicator by yourself or would you need support from experts?
6. If you need support from experts, which kind of support would you need (e.g., specific competences or time in terms of hours of work)?
7. In your opinion, the difficulty level associated with the implementation of the indicator is low, medium, high?

Pilots were finally given the possibility to give additional comments and feedback. All pilots made their contribution. Special thanks to the pilots for their precious cooperation.

MIGAL (i.e., the Israeli project partner in charge of the pilot) reported that the NBS they are considering within LENSES project has been implemented in Israel for many years already. Most of the indicators presented in the framework have already been used and are considered easy to use and sometimes already well incorporated within ordinary management practices. For example, with reference to the indicator 2.3.1 “Indication of NBS as planning options” the following was

emphasized "*Since in practice NBS is used, there are no need for mentioning in regulations"*. With reference to dimension 4 "Appropriate Regulatory Environment" it is commented that the use of clear and defined construction permits, safety and performance codes and standards, procurement policies and land use designation "*it is a common practice in Israel*"; with regard to the dimension 5 "Technical Capacity" it is specified that "*MIGAL is very much connected to farmers, farmers' organization and the Ministries of Agriculture and Protecting the Environment*" and that there is no "*need to organize any training and courses, since NBS is practically implemented".* Finally, the dimensions 6 "Access to Finance" and 7 "NBS Management" that had not been specifically addressed, however the following general comment was provided: "*Since in Israel the farmers are aware and use NBS regularly, there are no presence and use of strategies to monitor and evaluate the NBS activities, nor financial support that we are aware of*".

ECOADAPTA (i.e., the Spanish project partner in charge of the pilot) focused on commenting on the usefulness and clarity of the indicators, except for dimension 4 "Appropriate Regulatory Environment" whose indicators suggested to evaluate aspects not yet considered.

All the other pilots gave feedback on the indicators pointing out when they are perceived as not clear or not useful, and whether they refer to relevant aspects not yet considered, as well as whether their implementation is easy or difficult. Finally, the Italian pilot commented that "*all the indicators are interesting*" and suggested that "*some indicators could be merged with others because they are very numerous".*

A summary of all feedback and comments received from pilots is presented in Annex 4.

Most of the indicators seem to need support in terms of hours of work, competencies, or both to be evaluated. The indicator 1.3.2 "Management of the negative impacts' strategy" is not clear for most pilots. This is also the case for the indicators 2.1.1 "European, national and sub-national policies supporting NBS", 3.1.1 "Implementation of a successful NBS", 3.2.1 "Contribution of NBS to national and global targets", 4.3.1 "Clear and defined safety and performance codes and standards", 4.4.1 "Clear procurement policies", 6.3.1 "Financial sustainability for some of the pilots". Not clear or not useful for most of the pilots is instead the indicator 5.3.2 "Knowledge courses".

In general, main problems (as for understanding and use) are reported for indicators falling within the dimensions 3 "Supporting Policies", 4 "Appropriate Regulatory Environment", 5 "Technical Capacity" - especially the indicators related to key elements "Partnerships and information sharing" and "Training and education" and 6 "Access to Finance".

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

8. Framework application

MIGAL Galilee Research Institute and NARC (National Agriculture Research Center), i.e., respectively the Israeli and Jordan project partners in charge of the pilots in the two countries, not only worked on validating the framework but also applied the scoring scale (Table 20).

In none of the pilots the full set of indicators was covered. For example, in the case of the Israeli pilot, no indicators related to dimension 6 “Access to Finance” were considered. The results of the scoring test are reported in Table 20. It can be observed that the requirements proposed by the dimensions 1 and 3 are largely covered by the pilots; aspects related to the dimension 4 and the dimension 7 are covered to a lesser extent, but still quite broadly, while for dimension 5 a more patchy and irregular coverage is noticed. The results show that the main gaps for MIGAL are related to the dimension 2 and especially to the indicator 2.3.1 highlighting the problem of integrating NBS into planning strategies.

The results of the test by the Jordan pilot are reported in Table 21. They revealed that the requirements proposed by the dimensions 1 and 7 are largely covered by the pilot; aspects related to the dimensions 3, 4 and 5 are less covered compared to the above-mentioned dimensions 1 and 7, but still well covered. Instead, poor coverage is reported for the dimensions 2 and 6.

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

Table 20: Framework application in the Israel pilot

#	Key dimension	Dimension's score	##	Key elements	Element Weight	Element's score	###	Indicators	Indicator Weight	Indicator's score	Description	Sub-indicator	Scoring
1	CONDUCIVE GOVERANCE ARRANGEMENTS	0,875	1	Responsibilities for different aspects of NBS phases (planning, implementation, and maintenance)	25%	1,00	1	Clearly defined structure and roles	50%	1	Dedicated actors for NBS planning, implementation, and maintenance	Planning	1
												Implementation	1
												Maintenance	1
							2	NBS responsibilities	50%	1	Well defined actors' responsibilities for each NBS phases	Planning	1
												Implementation	1
												Maintenance	1
			2	Coordination mechanisms (horizontal and vertical)	50%	0,75	1	Participation in all processes of the NBS intervention	20%	1	Use of participatory approaches in decision-making in all the phases of NBS intervention	Planning	1
												Implementation	1
												Maintenance	1
							1.1	Equity in participatory processes	2%	1	The participation is based on mutual respect and equity, regardless of gender, age or social status, and upholds the right of Indigenous Peoples to Free, Prior and Informed Consent (FPIC)	Gender	1
												Age	1
												Social status	1
												Indigenous right	1
							1.2	Represented stakeholders	3%	1	Identification and involvement of direct and indirect stakeholders affected by the NBS		1
							2	Represented interest of stakeholders	25%	1	The decision-making processes documents and responds to the rights and interests of all participating and affected stakeholders		1
							3	Intra-organizational coordination	25%		Presence of coordination mechanisms among NBS stakeholders (e.g., public institutions, economic bodies, stakeholders)		
							4	Inter-organizational coordination	25%	1	Where the scale of the NBS extends beyond jurisdictional boundaries, mechanisms are established to enable joint		1

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

#	Key dimension	Dimension's score	##	Key elements	Element Weight	Element's score	###	Indicators	Indicator Weight	Indicator's score	Description	Sub-indicator	Scoring
											decision-making of the stakeholders in the affected jurisdictions		
			3	Stakeholder endorsement	25%	1,00	1	Community supporting the NBS	50%	1	The NBS achieves a high level of support from the community		1
							2	Management of the negative impacts' strategy	50%	1	Presence and use of instruments to manage the negative impacts affecting stakeholders		1
2	SUPPORTIVE POLICIES	0	1	Clear mandate and support for NBS	25%		1	European, national and sub-national policies supporting NBS	100%		Reference to NBS		
			2	Coherence between sectoral policies, and mechanisms to address trade-offs	25%		1	European, national and sub-national policies' objectives	100%		Absence of conflicting objectives among the sectoral policies		
			3	Encouragement of NBS within infrastructure planning processes	50%	0,00	1	Indication of NBS as planning options	100%	0	Mention of NBS within the land use planning regulations, strategies, and plans	Land use planning regulations	0
												Strategies	0
												Plans	0
3	SUPPORTING POLICIES	1	1	Encouragement of NBS adoption towards its positive outcomes	50%	1,00	1	Implementation of a successful NBS	100%	1	The NBS facilitates policy and regulation frameworks to support its uptake and mainstreaming	Uptake	1
												Mainstreaming	1
			2	Methodologies in place for measuring NBS contribution	50%	1,00	1	Contribution of NBS to national and global targets	100%	1	Presence of procedures capturing the NBS contribution to national and global targets for human well-being, climate change, biodiversity and human rights.	Human well-being	1
												Climate change	1
												Biodiversity	1
												Human rights	1
4	APPROPRIATE REGULATORY ENVIRONMENT	0,48	1	Land-use regulation and zoning	16%	1,00	1	Land use designation	100%	1	Presence of documents defining the land use of the area (e.g., maps, regulations)		1

PRIMA PARTNERSHIP FOR RESEARCH AND INNOVATION IN THE MEDITERRANEAN AREA

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

#	Key dimension	Dimension's score	##	Key elements	Element Weight	Element's score	###	Indicators	Indicator Weight	Indicator's score	Description	Sub-indicator	Scoring
			2	Permitting	16%	0,00	1	Clear and defined construction permits	100%	0	Presence of needed permits to implement the selected NBS		0
			3	Safety and performance codes and standards	16%	1,00	1	Clear and defined safety and performance codes and standards	100%	1	Presence of codes and standards needed to implement the selected NBS (e.g., safety, ...)		1
			4	Procurement policies	16%		1	Clear procurement policies	100%		Presence of policies		
			5	Land rights	20%	0,00	1	Clear land and resources tenure, usage, and access rights	50%	0	Existence of well-defined land resources tenure, usage, and access rights	Tenure	0
												Usage	0
												Access right	0
							2	Acknowledge and observance of the land and resources tenure, usage, and access rights	50%		The tenure, usage of and access rights to land and resources, along with the responsibilities of different stakeholders, are acknowledged and respected	Tenure	
												Usage	
												Access right	
			6	Environmental protection regulation	16%	1,00	1	Clear environmental protection regulation	100%	1	Presence of compliance environmental protection regulation		1
5	TECHNICAL CAPACITY	0,32	1	Partnerships and information sharing	40%	0,80	1	Stakeholders' network cohesion to optimize interdisciplinary co-creation and co-design of NBS	80%	1	Exchange of information (by phone, mail, letter, personally) among stakeholders regarding NBS project		1
							2	Procedures for collecting comments	20%	0	Use of formal procedures to allow stakeholders to provide their comments/contributes before and during the NBS intervention	Before	0
												During	0
			2	Integration of NBS training in civil engineering and	25%	0,00	1	Training in NBS	100%	0	Presence of specific NBS course to improve NBS adoption (to engineers,	Course	0
												Education	0

#	Key dimension	Dimension's score	##	Key elements	Element Weight	Element's score	###	Indicators	Indicator Weight	Indicator's score	Description	Sub-indicator	Scoring
				urban planning curricula							planners' bodies of public administration) or NBS-related education (in university curricula)		
			3	Training and education	35%	0,00	1	Collaborative leaning among stakeholders	50%	0	Presence of bidirectional flows of collaborative learning among stakeholders		0
							2	Knowledge courses	50%		The lead organization organizes specializing courses open to residents and stakeholders	Residents	
												Stakeholders	
6	ACCESS TO FINANCE		1	Availability of targeted incentives	25%		1	European, national and sub-national resourcing options (policies, financial instruments, etc.) supporting NBS	100%		Availability of a portfolio of resourcing options for NBS		
			2	Ability to capture revenue streams	25%		1	Completeness of income sources	100%		Presence of professional project design team and complete project management system	Design team	
												Management system	
			3	Financing requirements	25%		1	Financial sustainability	100%		Presence of professional project design team and complete project management system	Design team	
												Management system	
			4	Distribution of liabilities	25%		1	Legal responsibilities	100%		Well defined legal responsibilities related to NBS implementation		
7	NBS MANAGEMENT	0,5	1	NBS monitoring	50%		1	Monitoring and evaluation strategy	50%		Presence and use of strategies to periodically monitor and evaluate the NBS intervention throughout its lifecycle		
							2	Adaptive NBS intervention management	50%		Presence and use of iterative learning process that enables an adaptive NBS intervention management throughout its lifecycle		

PRIMA PARTNERSHIP FOR RESEARCH AND INNOVATION IN THE MEDITERRANEAN AREA

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

#	Key dimension	Dimension's score	##	Key elements	Element Weight	Element's score	###	Indicators	Indicator Weight	Indicator's score	Description	Sub-indicator	Scoring
			2	NBS safeguard	50%	1,00	1	NBS safeguard system	50%	1	Presence and use of a safeguard system to ensure that mutually agreed trade-off limits are respected and do not destabilize the entire NBS intervention		1
							2	Risk strategy	50%	1	Presence of strategies that allow the identification and management of possible risks' type and level		1

PRIMA PARTNERSHIP FOR RESEARCH AND INNOVATION IN THE MEDITERRANEAN AREA

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

Table 21: Framework application in the Jordan pilot

#	Key dimension	Dimension's score	##	Key elements	Element Weight	Element's score	###	Indicators	Indicator Weight	Indicator's score	Description	Sub-indicator	Scoring
1	CONDUCIVE GOVERANCE ARRANGEMENTS	0,875	1	Responsibilities for different aspects of NBS phases (planning, implementation, and maintenance)	25%	1,00	1	Clearly defined structure and roles	50%	1	Dedicated actors for NBS planning, implementation, and maintenance	Planning	1
												Implementation	1
												Maintenance	1
							2	NBS responsibilities	50%	1	Well defined actors' responsibilities for each NBS phases	Planning	1
												Implementation	1
												Maintenance	1
			2	Coordination mechanisms (horizontal and vertical)	50%	1,00	1	Participation in all processes of the NBS intervention	20%	1	Use of participatory approaches in decision-making in all the phases of NBS intervention	Planning	1
												Implementation	1
												Maintenance	1
							1.1	Equity in participatory processes	2%	1	The participation is based on mutual respect and equity, regardless of gender, age or social status, and upholds the right of Indigenous Peoples to Free, Prior and Informed Consent (FPIC)	Gender	1
												Age	1
												Social status	1
												Indigenous right	1
							1.2	Represented stakeholders	3%	1	Identification and involvement of direct and indirect stakeholders affected by the NBS		1
							2	Represented interest of stakeholders	25%	1	The decision-making processes documents and responds to the rights and interests of all participating and affected stakeholders		1
							3	Intra-organizational coordination	25%	1	Presence of coordination mechanisms among NBS stakeholders (e.g., public institutions, economic bodies, stakeholders)		1
							4	Inter-organizational coordination	25%	1	Where the scale of the NBS extends beyond jurisdictional boundaries, mechanisms are established to enable joint decision-making of the stakeholders in the affected jurisdictions		1

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

#	Key dimension	Dimension's score	##	Key elements	Element Weight	Element's score	###	Indicators	Indicator Weight	Indicator's score	Description	Sub-indicator	Scoring
			3	Stakeholder endorsement	25%	0,50	1	Community supporting the NBS	50%	1	The NBS achieves a high level of support from the community		1
							2	Management of the negative impacts' strategy	50%	0	Presence and use of instruments to manage the negative impacts affecting stakeholders		0
2	SUPPORTIVE POLICIES	0	1	Clear mandate and support for NBS	25%		1	European, national and sub-national policies supporting NBS	100%		Reference to NBS		
			2	Coherence between sectoral policies, and mechanisms to address trade-offs	25%		1	European, national and sub-national policies' objectives	100%		Absence of conflicting objectives among the sectoral policies		
			3	Encouragement of NBS within infrastructure planning processes	50%	0,00	1	Indication of NBS as planning options	100%	0	Mention of NBS within the land use planning regulations, strategies, and plans	Land use planning regulations	0
												Strategies	0
												Plans	0
3	SUPPORTING POLICIES	0,5	1	Encouragement of NBS adoption towards its positive outcomes	50%		1	Implementation of a successful NBS	100%		The NBS facilitates policy and regulation frameworks to support its uptake and mainstreaming	Uptake	
												Mainstreaming	
			2	Methodologies in place for measuring NBS contribution	50%	1,00	1	Contribution of NBS to national and global targets	100%	1	Presence of procedures capturing the NBS contribution to national and global targets for human well-being, climate change, biodiversity and human rights.	Human well-being	1
												Climate change	1
												Biodiversity	1
												Human rights	1
4	APPROPRIATE REGULATORY ENVIRONMENT	0,52	1	Land-use regulation and zoning	16%	1,00	1	Land use designation	100%	1	Presence of documents defining the land use of the area (e.g., maps, regulations)		1
			2	Permitting	16%	0,00	1	Clear and defined construction permits	100%	0	Presence of needed permits to implement the selected NBS		0
			3	Safety and performance codes and standards	16%	0,00	1	Clear and defined safety and performance codes and standards	100%	0	Presence of codes and standards needed to implement the selected NBS (e.g., safety, ...)		0
			4	Procurement policies	16%		1	Clear procurement policies	100%		Presence of policies		
			5	Land rights	20%	1,00	1		50%	1		Tenure	1

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

#	Key dimension	Dimension's score	##	Key elements	Element Weight	Element's score	###	Indicators	Indicator Weight	Indicator's score	Description	Sub-indicator	Scoring
								Clear land and resources tenure, usage, and access rights			Existence of well-defined land resources tenure, usage, and access rights	Usage	1
												Access right	1
							2	Acknowledge and observance of the land and resources tenure, usage, and access rights	50%	1	The tenure, usage of and access rights to land and resources, along with the responsibilities of different stakeholders, are acknowledged and respected	Tenure	1
												Usage	1
												Access right	1
			6	Environmental protection regulation	16%	1,00	1	Clear environmental protection regulation	100%	1	Presence of compliance environmental protection regulation		1
5	TECHNICAL CAPACITY	0,575	1	Partnerships and information sharing	40%	1,00	1	Stakeholders' network cohesion to optimize interdisciplinary co-creation and co-design of NBS	80%	1	Exchange of information (by phone, mail, letter, personally) among stakeholders regarding NBS project		1
							2	Procedures for collecting comments	20%	1	Use of formal procedures to allow stakeholders to provide their comments/contributes before and during the NBS intervention	Before	1
												During	1
			2	Integration of NBS training in civil engineering and urban planning curricula	25%	0,00	1	Training in NBS	100%	0	Presence of specific NBS course to improve NBS adoption (to engineers, planners' bodies of public administration) or NBS-related education (in university curricula)	Course	0
												Education	0
			3	Training and education	35%	0,50	1	Collaborative leaning among stakeholders	50%	1	Presence of bidirectional flows of collaborative learning among stakeholders		1
							2	Knowledge courses	50%		The lead organization organizes specializing courses open to residents and stakeholders	Residents	
												Stakeholders	
6	ACCESS TO FINANCE	0	1	Availability of targeted incentives	25%	0,00	1	European, national and sub-national resourcing options (policies, financial instruments, etc.) supporting NBS	100%	0	Availability of a portfolio of resourcing options for NBS		0
			2		25%	0,00	1		100%	0		Design team	0

PRIMA PARTNERSHIP FOR RESEARCH AND INNOVATION IN THE MEDITERRANEAN AREA

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

#	Key dimension	Dimension's score	##	Key elements	Element Weight	Element's score	###	Indicators	Indicator Weight	Indicator's score	Description	Sub-indicator	Scoring
				Ability to capture revenue streams				Completeness of income sources			Presence of professional project design team and complete project management system	Management system	0
			3	Financing requirements	25%		1	Financial sustainability	100%		Presence of professional project design team and complete project management system	Design team	
												Management system	
			4	Distribution of liabilities	25%	0,00	1	Legal responsibilities	100%	0	Well defined legal responsibilities related to NBS implementation		0
7	NBS MANAGEMENT	0,75	1	NBS monitoring	50%	1,00	1	Monitoring and evaluation strategy	50%	1	Presence and use of strategies to periodically monitor and evaluate the NBS intervention throughout its lifecycle		1
							2	Adaptive NBS intervention management	50%	1	Presence and use of iterative learning process that enables an adaptive NBS intervention management throughout its lifecycle		1
			2	NBS safeguard	50%	0,50	1	NBS safeguard system	50%	0	Presence and use of a safeguard system to ensure that mutually agreed trade-off limits are respected and do not destabilize the entire NBS intervention		0
							2	Risk strategy	50%	1	Presence of strategies that allow the identification and management of possible risks' type and level		1

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

9. Conclusion

The intent of the report was to produce a useful tool to allow the pilots to assess the policy enabling environment, as well as address governance challenges for NBS.

The investigation on how the concepts of WEFE Nexus and NBS are addressed in key European and international policy documents showed that individual elements of the WEFE Nexus find space into different policy areas and mainly concern: water quality, water infrastructure, water availability, water use, water stress, water for economic growth and sustainable development, water resources management; safe, sufficient and nutritious food, locally and regionally diversified food production, food security, food waste, nutrition, agro-ecological practices, agricultural productivity, sustainable food production; energy management, energy supply, energy efficiency, renewable energy production, affordable and secure energy systems; land use planning, habitat conservation and ecosystem protection. However, the explicit concept of WEFE Nexus finds space only into few documents at both the European and international levels, and especially in policy areas involving water, climate, energy, development and research programs.

The concept of NBS has emerged within different policy areas at both the European and international levels. The concept is declined in different forms and the terminology adopted ranges from the following concepts: ecosystem-based approaches, ecosystem-based adaptation, ecosystem-based disaster risk reduction, green infrastructure/blue and green infrastructure, and sustainable management/ecosystem-based management/sustainable forest management.

Therefore, having realized a policy analysis tool useful to guide LENSES pilots to investigate WEFE and NBS concepts also within national and subnational policies, we developed a framework that help LENSES pilots and possible users to assess the conditions in their own implementation context to ensure the success of an NBS project. The framework created consists of 7 key dimensions, 23 key elements, 35 indicators. The feedback from the pilots shows that most of the indicators seem to need support in terms of hours of work, competencies, or both in order to be evaluated and the indicators falling within the dimensions 3 "Supporting Policies," 4 "Appropriate Regulatory Environment," 5 "Technical Capacity"- especially the indicators related to key elements "Partnerships and information sharing" and "Training and education" and 6 "Access to Finance" need to be clarified in their meaning and use. Therefore, the framework can be further elaborated and improved through users' suggestions.

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

References

Adamovic, M., Al-Zubari, W., Amani, A., Ameztoy Aramendi, I., Bacigalupi, C., Barchiesi, S., Bisselink, B., Bodis, K., Bouraoui, F., Caucci, S., Dalton, J., De Roo, A., Dudu, H., Dupont, C., El Kharraz, J., Embid, A., Farajalla, N., Fernandez Blanco Carramolino, R., Ferrari, E., Ferrini, L., Filali-Meknassi, Y., Franca, M., Ghaffour, N., Girardi, V., Grizzetti, B., Hannah, C., Hidalgo Gonzalez, I., Houmoller, O., Jaeger-Waldau, A., Jimenez Cisneros, B., Kavvadias, K., Kougias, I., Laamrani, H., Lemessa Tesgera, S., Liebaerts, A., Lipponen, A., Lorentzen, J., Makarigakis, A., Marence, M., Martin, L., Michalena, E., Mishra, A., Mohtar, R., Moner Gerona, M., Moreno-Abat, M., Mpakama, Z., Pastori, M., Pistocchi, A., Sartori, M., Schmeier, S., Schmidt-Vogt, D., Sehring, J., Smakhtin, V., Szabo, S., Takawira, A., Thiem, M., Tiruneh, J., Tsani, S., Van Hullebusch, E., Verbist, K., Xenarios, S. and Zaragoza, G. 2019. Position Paper on Water, Energy, Food and Ecosystem (WEFE) Nexus and Sustainable development Goals (SDGs), Carmona Moreno, C., Dondeynaz, C. and Biedler, M. editor(s), EUR 29509 EN, Publications Office of the European Union, Luxembourg, ISBN 978-92-76-00159-1, doi:10.2760/31812, JRC114177.

Barrow**,** E. 2014. 300,000 Hectares Restored in Shinyanga, Tanzania — but what did it really take to achieve this restoration? S.A.P.I.E.N.S [Online], 7.2 |, Online since 22 April 2014, connection on 24 October 2022. URL: http://journals.openedition.org/sapiens/1542.

Carmona-Moreno, C., Dondeynaz, C., Biedler, M. 2019. Position Paper on Water, Energy, Food, and Ecosystem (WEFE) Nexus and Sustainable development Goals (SDGs), EUR 29509 EN, Publications Office of the European Union, Luxembourg. ISBN 978-92-79-98276-7. doi:10.2760/5295, JRC114177.

Cashore, B., Bernstein, S., Humphreys, D., Visseren-Hamakers, I., Rietig, K. 2019. Designing stakeholder learning dialogues for effective global governance, Policy and Society, Volume 38, Issue 1, Pages 118–147. doi:10.1080/14494035.2019.1579505.

Da Re, R. 2012. Governance of natural resources and development of local economies in rural areas: the Social Networks Analysis and other instruments for good governance indicators. Doctorate thesis.

Dale P, Sporne I, Knight J, Sheaves M, Eslami-Andergoli L, Dwyer P. 2019. A conceptual model to improve links between science, policy and practice in coastal management. Mar. Policy 103, 42-49. doi:10.1016/j.marpol.2019.02.029.

Davis, M., Abhold, K., Mederake, L., Knoblauch, D., 2017. Nature-based solutions in European and national policy frameworks. Deliverable 1.5, NATURVATION. Horizon 2020 Grant Agreement No 730243, European Commission, 42 pp.

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

Dick, J., Miller, J.D., Carruthers-Jones, J. *et al.*, 2019. How are nature-based solutions contributing to priority societal challenges surrounding human well-being in the United Kingdom: a systematic map protocol. Environ Evid 8, 37. doi:10.1186/s13750-019-0180-4.

Dumitru, A., Wendling, L., Eiter, S., and Pilla, F., 2021. Evaluating the Impact of Nature-Based Solutions," in A Handbook for Practitioners. Belgium: Directorate-General for Research and Innovation.

Eisenberg, B., Polcher, V., Chiesa, C., 2018. Nature Based Solutions Technical Handbook, D5.1 NBS Technical Handbook, 31/05/18, Deliverable 5.1 for the UNaLab H2020 project, GA no. 730052, 2018.

European Commission, Directorate-General for Research and Innovation, 2021. Evaluating the impact of nature-based solutions: a handbook for practitioners, Publications Office of the European Union.

European Commission, 2016. Policy Topics: Nature-Based Solutions. https:// ec.europa.eu/research/environment/index.cfm?Pg=nbs.

Harman B.P., Heyenga S., Taylor B.M., Fletcher C.S., 2013, Global lessons for adapting coastal communities to protect against storm surge inundation. J. Coast. Res. 31, 790-801. ISI, Google Scholar.

Hoff, H., 2011. Understanding the Nexus. Background Paper for the Bonn 2011 conference: the water, energy and food security Nexus. Stockholm Environment Institute, Stockholm. http://sei-international.org/publications?pid=1977.

Infrastructure Australia, 2020. Guide to multi-criteria analysis. Technical guide of the Assessment Framework.

IUCN, 2020. Global Standard for Nature-based Solutions. A user-friendly framework for the verification, design and scaling up of NbS. First edition. Gland, Switzerland: IUCN. ISBN: 978-2-8317-2058-6.

Kabisch, N., Frantzeskaki, N., Pauleit, S., Naumann, S., Davis, M., Artmann, M., Haase, D., Knapp, S., Korn, H., Stadler, J., Zaunberger, K., Bonn, A., 2016. Nature-based solutions to climate change mitigation and adaptation in urban areas: perspectives on indicators, knowledge gaps, barriers, and opportunities for action. Ecology and Society 21(2):39. doi:10.5751/ES-08373-210239.

Liu, J., Hull, V., Godfray, H.C.J., 2018. Nexus approaches to global sustainable development. Nat Sustain 1, 466–476. doi:10.1038/s41893-018-0135-8.

Lupp, G., Zingraff-Hamed, A., Huang, J.J., Oen, A., Pauleit, S., 2021. Living Labs—A Concept for Co-Designing Nature-Based Solutions. Sustainability 2021, 13, 188. doi:10.3390/su13010. 88.

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

Maes, J., Jacobs, S., 2015. Nature-based solutions for Europe's sustainable development, Conserv. Lett., doi:10.1111/conl.12216.

Martin, J.G.C., Scolobig, A., Linnerooth-Bayer, J., Liu, W., Balsiger, J., 2021. Catalyzing Innovation: Governance Enablers of Nature-Based Solutions. Sustainability, 13, 1971. doi:10.3390/su13041971.

MEA, 2005. A Report of the Millennium Ecosystem Assessment. Ecosystems and Human Well-Being. Island Press, Washington DC.

Nesshöver, C., Assmuth, T., Irvine, K. N., Rusch, G. M., Waylen, K. A., Delbaere, B., Haase, D., Jones-Walters, L., Keune, H., Kovacs, E., Krauze, K., Külvik, M., Rey, F., van Dijk, J., Inge Vistad, O., Wilkinson, M.E., Wittmer, H., 2017. The science, policy and practice of nature-based solutions: An interdisciplinary perspective, Science of The Total Environment, Volume 579, Pages 1215-1227. ISSN 0048-9697. doi:10.1016/j.scitotenv.2016.11.106.

OECD, 2020. Nature-based solutions for adapting to water-related climate risks: Policy Perspectives. OECD Environment Policy Paper No. 21. ISSN 2309-7841.

Reid, H. and Ali, L., 2019. Ecosystem-based approaches to adaptation: strengthening the evidence and informing policy: Research results from the Incentive-based Hilsa Conservation Programme, Bangladesh London, UK: IIED http://pubs iied org/17625IIED.

Ruangpan, L., Vojinovic, Z., Di Sabatino, S., Leo, L. S., Capobianco, V., Oen, A.M.P., McClain, M.E., and Lopez- Gunn, E. 2020. Nature-based solutions for hydro-meteorological risk reduction: a state-of-the-art review of the research area, Natural Hazards and Earth System Sciences, Vol. 20, pp. 243–270.

Seddon N., Chausson A., Berry P., Girardin C. A. J., Smith A., Turner B. 2020. Understanding the value and limits of nature-based solutions to climate change and other global challenges. Phil. Trans. R. Soc. Doi:10.1098/rstb.2019.0120.

te Velde, D. W., Calow, R., Mason, N., Lemma, A., Faure, R., Massa, I., Newborne, P. 2012. The 2011/2012 European Report on Development, Confronting Scarcity: Managing Water, Energy and Land for Inclusive and Sustainable Growth, Overseas Development Institute (ODI), European Centre for Development Policy Management (ECDPM), German Development Institute/Deutsches Institut für Entwicklungspolitik (GDI/DIE), European Union.

Wuijts, S., Driessen, P.P.J., Van Rijswick, H.F.M.W., 2018. Towards more effective water quality governance: A review of social-economic, legal and ecological perspectives and their interactions. *Sustainability* 10: 914.

Zingraff-Hamed, A., Martin, J.G.C., Lupp, G., Linnerooth-Bayer, J., Pauleit, S. 2019. Designing a Resilient Waterscape Using a Living Lab and catalyzing Polycentric Governance. Landscape Architecture Frontiers 7 (3) 12-31. doi:10.15302/J-LAF-1-020003.

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

Zingraff-Hamed, A., Hüesker, F., Lupp, G., Begg, C., Huang, J., Oen, A.M., Vojinovic, Z., Kuhlicke, C., & Pauleit, S., 2020. Stakeholder Mapping to Co-Create Nature-Based Solutions: Who Is on Board? *Sustainability*.

Zingraff-Hamed, A., Hüesker, F., Albert, C., Brillinger, M., Huang, J., Lupp, G., Scheuer, S., Schlätel, M., Schröter, B. 2021. Governance models for nature-based solutions: Seventeen cases from Germany. Ambio 50, 1610–1627. doi:10.1007/s13280-020-01412-x.

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]